CABINET GORGE HATCHERY
ANNUAL REPORT

October 1, 1989 to December 31, 1990

Prepared by

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INTRODUCTION

Cabinet Gorge Hatchery is located in Bonner County, Idaho approximately eight miles southeast of the small community of Clark Fork. Constructed in 1985, the hatchery produces advanced-stage late-spawning kokanee salmon fry for Lake Pend Oreille (Table 1). These fry are needed to mitigate for the loss of wild kokanee recruitment caused by hydroelectric power projects on the Pend Oreille watershed. The hatchery also controls timing of the release of these fish to coincide with the altered cycles of zooplankton blooms in the lake caused by Mysis shrimp.

Staffing at the hatchery includes two permanent personnel, one temporary, one year-long maintenance craftsman, 8 months of bio-aide time, and another 17 months of temporary time. Housing accommodations include two residences for the permanent staff and crew quarters for two seasonal employees.

Because the period covered by the annual report has been changed to a calendar year, this report contains spawntaking information from two seasons; 1989 and 1990. However, only bull trout and kokanee will be affected by this change.

Water Supply

Cabinet Gorge Dam is located about one mile upstream from the hatchery. After its completion in 1952 and the resultant water level rise, artesian springs began appearing along the river at the present site of the hatchery. The hatchery utilizes these springs by pumping up to 20 cfs of water to the hatchery using six pumps in two well fields. The lower spring and upper well field vary inversely with each other over a 12-month period (Figure 1). A mixture of the two water sources allowed incubation water to be kept around 10°C (50°F) to promote feed training. Production water ranged from 4.7°C (40.5°F) to 11.0°C (51.8°F) (Figure 2).

Rearing Facilities

Rearing facilities at the hatchery include 192 upwelling incubators measuring 12 inches in diameter and having a capacity of 130,000 eggs per incubator. There are 64 concrete raceways which have a rearing space of 32,000 cubic feet. Approximately one-third of the area of these is enclosed by the hatchery building. The adult holding area contains three holding ponds (10 ft x 30 ft each). A trapping area (10 ft x 20 ft) is provided at the head of the fish ladder. Unfortunately, the fish have to be hauled from the trapping area to the adult holding ponds to be spawned.

Table 1. Kokanee requested and produced.

Species & size	Production goal	Actual production	Percentage of goal achieved
Kokanee fry	15,000,000	7,777,700	51.9%

AVERAGED MONTHLY WATER TEMPERATURE IN UPPER WELL & LOWER SPRINGS, BY 86-90.

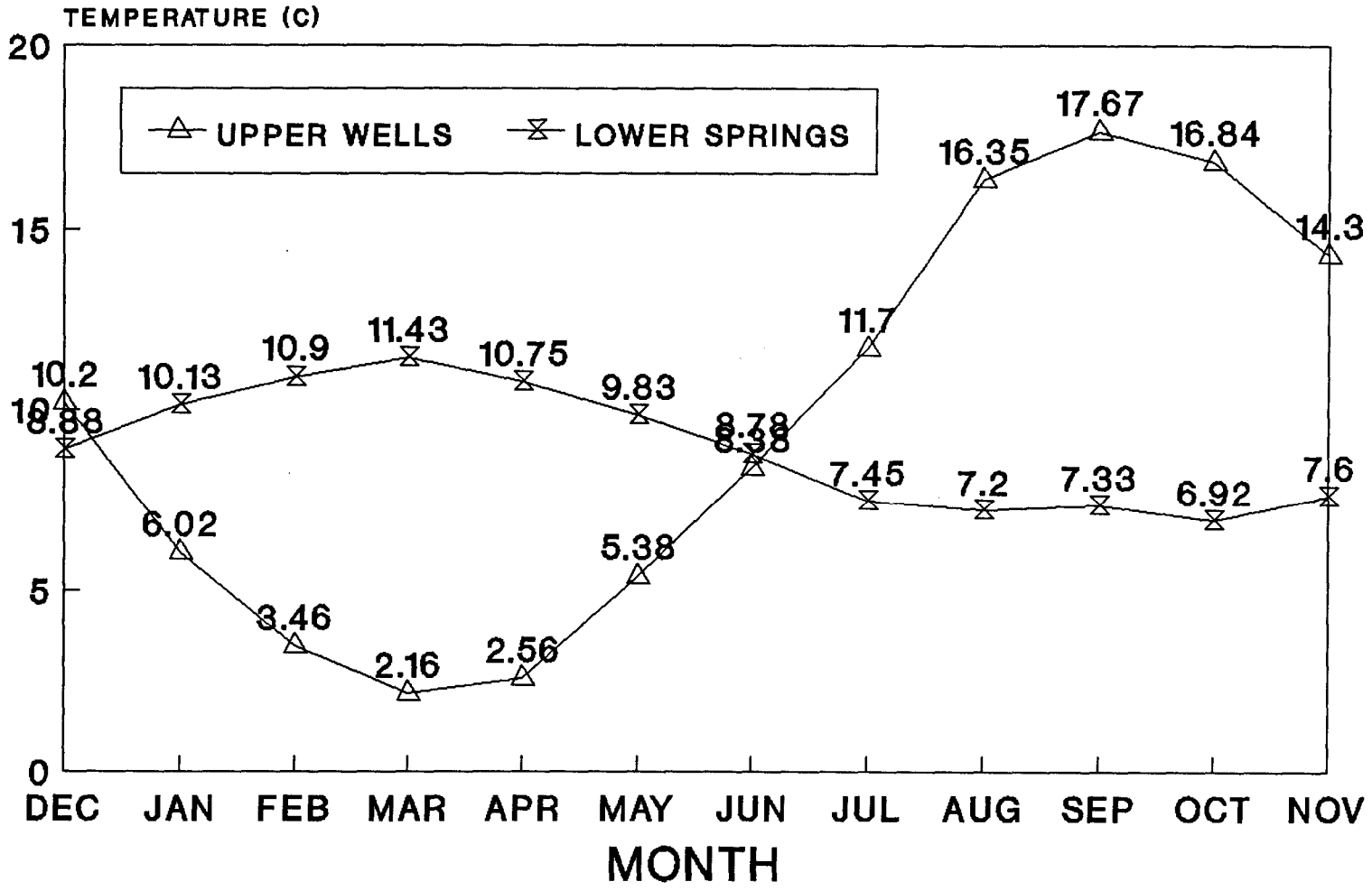

Figure 1. Temperature profile of both water sources, 1986-90

PRODUCTION AND INCUBATION TEMPERATURES
1989

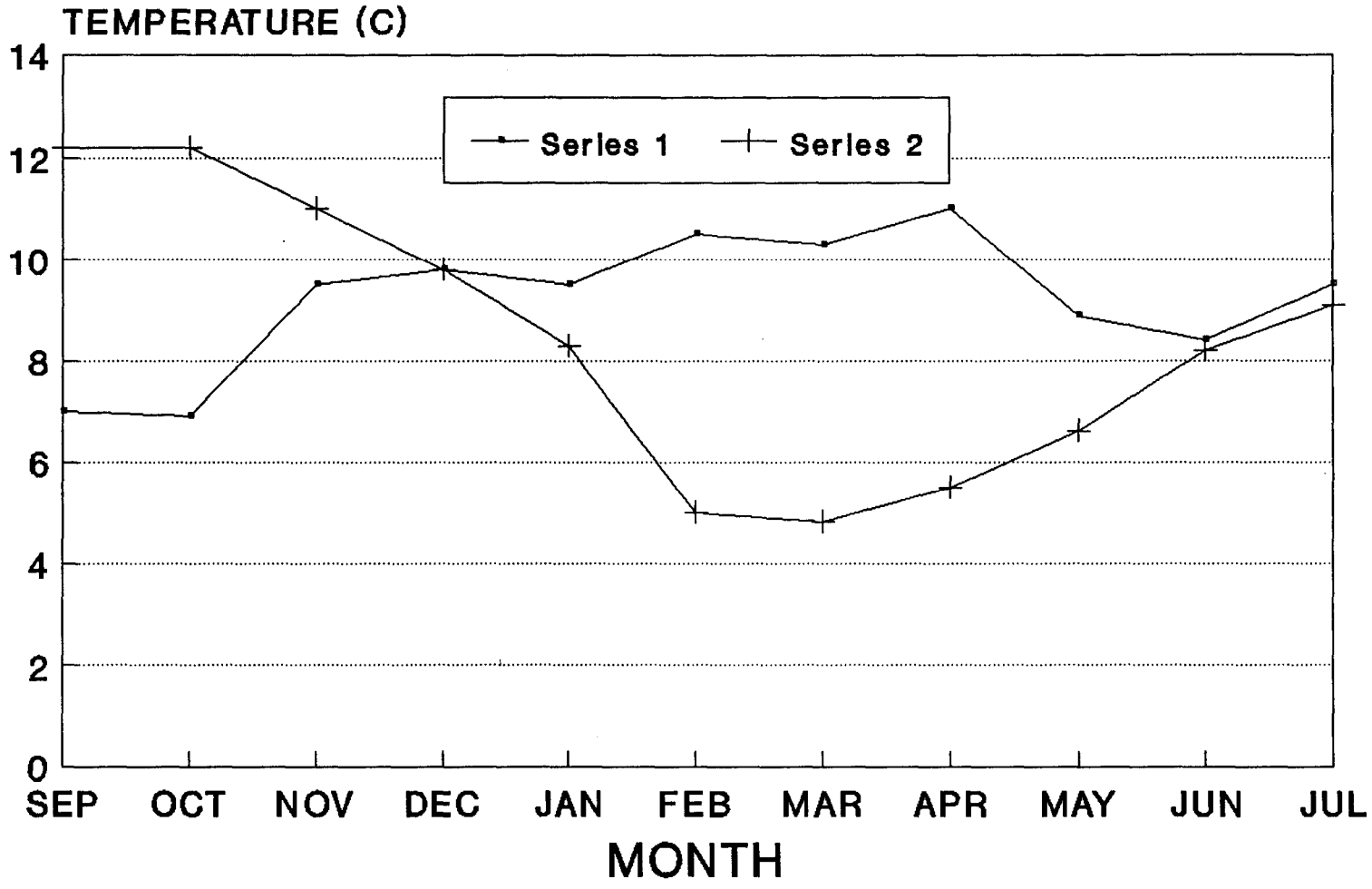

Figure 2. Temperature profile of rearing water, 1989-90.

PRODUCTION

Between October 1, 1989 and December 31, 1990, Cabinet Gorge Hatchery released a total of 8,240,400 fish weighing 29,381 pounds (Table 2). About 5,600,000 kokanee eggs and newly-hatched fry were on hand on December 31, 1990.

A total of 31,037 pounds of feed produced 28,865 pounds of gain for a conversion of 1.08 overall. Average cost per pound of feed was $0.516 (including freight), resulting in a feed cost per pound of fish of $0.55. Total production cost (less capital outlay) was $193,501 (Figure 3), resulting in a cost per pound of fish of $6.59 and $23.48 per thousand.

Pend Oreille Kokanee

Fish Trapping

During 1989 and 1990, the Cabinet Gorge fish trap was in operation from the middle of September to the third week of December. In 1989, kokanee began entering the trap at the end of October, with the last kokanee trapped and spawned on December 19. Trapping yielded a total of 2,464 late-run kokanee (33% females and 67% males) (Table 3). Prespawning mortality of females was 2.7% compared to 1988 figures of 5.5%.

In 1990, kokanee began entering the trap at the end of October, with the last kokanee trapped and spawned on December 24. Trapping yielded a total of 4,991 late-run kokanee (30% females and 70% males) (Table 3). Prespawning mortality of females was 8.5%.

Spawntaking and Eggs Received

1989-Kokanee spawntaking began on November 6 and continued to January 3. The spawning operations peaked in early December at Sullivan Springs and late November at Cabinet Gorge Hatchery (Figure 4).

A total of **9,579,760** green kokanee eggs were received at Cabinet Gorge Hatchery during the 1989-90 production year. Of those, 207,936 were collected from 806 female kokanee at Cabinet Gorge Hatchery and the remaining 9,371,824 were received from the Sullivan Springs trap. About 8,100 kokanee were placed above the trap to spawn naturally and assure a future egg source. Spawning efficiency (the amount of eggs removed from the body) was 91% in 1989 and tied the overall record.

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Table 2. Production summary, all species, 1989-90.

Species	Number	Pounds	Length	Fish/lb	Ave. feed cost/lb (inc.frt.)	Conv.	Production cost	Cost/lb of fish
PdO KL	7,777,700	24,171	2.21	321.6	0.500	1.07	156,735.80	6.48
CdA KL	384,600	1,301	2.24	295.6	0.496	0.97	9,675.05	7.44
K2	22,600	2,499	6.64	9.0	0.601	1.19	5,805,03	2.32
C2 (Fing)	27,100	1,346	5.22	20.1	0.602	1.68	2,902.52	2.16
C2 (Fry)	25,000	9	1.28	2,876.9	N/A	N/A	967.51	111.21
Bull trout	3,400	56	3.79	61.3	1.810	1.12	7,740.04	139.46
F. Ch. eggs	55,491	N/A	N/A	N/A	N/A	N/A	9,675.05	N/A
Totals/Ave:	8,295,891	29,381	2.22	324.00	0.50	1.06	193,501.00	6.59

PRODUCTION COSTS FOR 1989-90
BUDGETARY BREAKDOWN

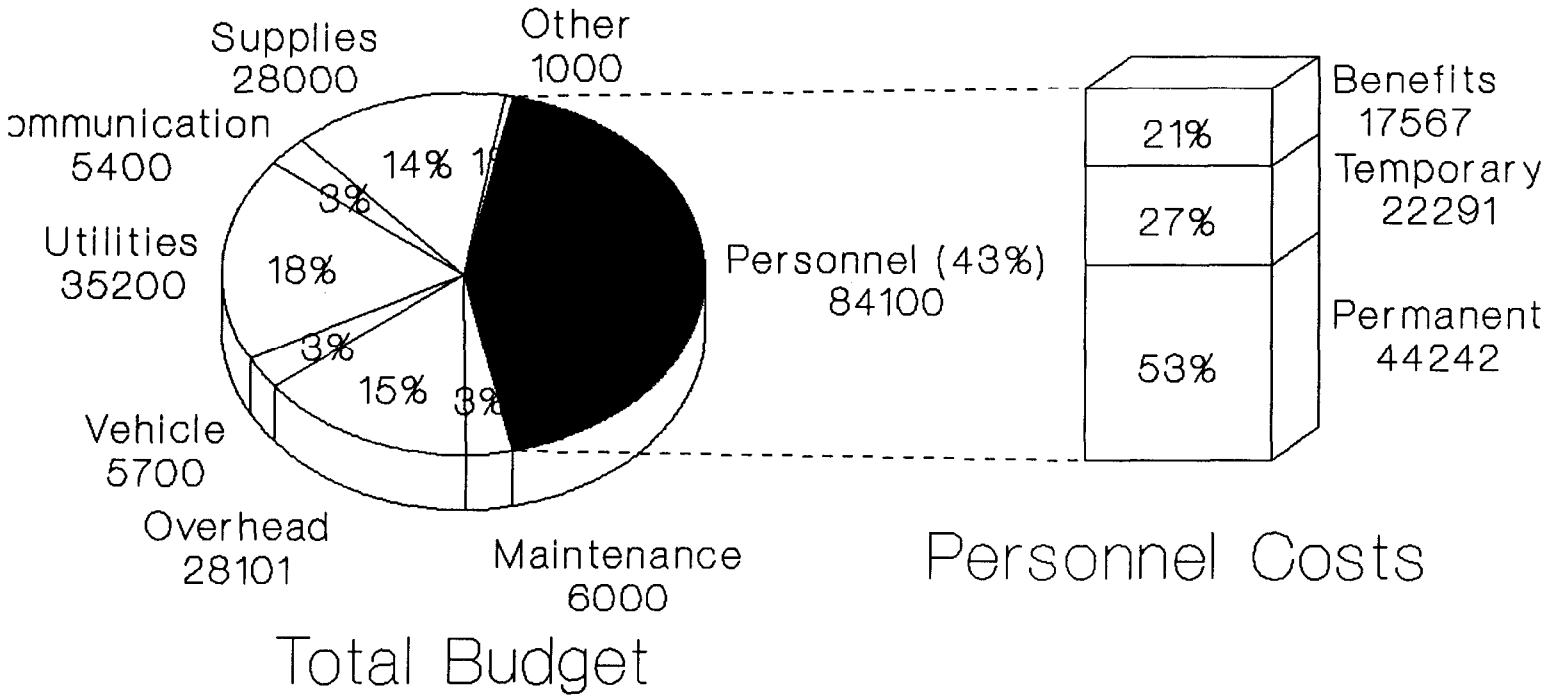

Figure 3. Production cost breakdown, 1989-90.

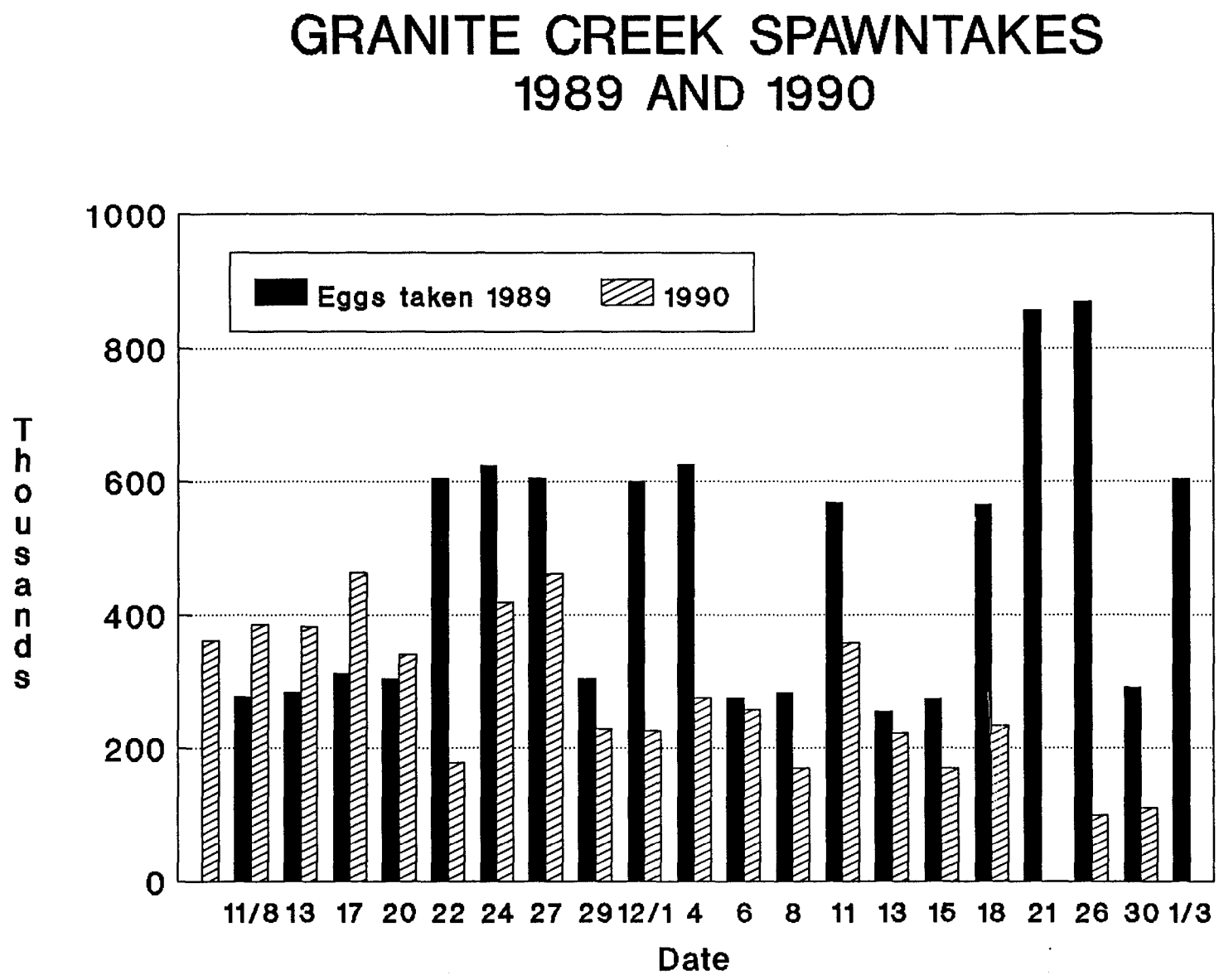

Figure 4. Kokanee egg takes at Granite Creek, 1989 & 1990.

1990-Kokanee spawntaking began on November 5 and continued to December 26. Spawning operations peaked in late November at Sullivan Springs and early December at Cabinet Gorge (Figure 4).

A total of 5,678,194 green kokanee eggs were collected during the 1990-91 production year. Of those, 351,718 were obtained from 1,379 female kokanee at Cabinet Gorge Hatchery and the remaining 5,331,975 were collected from the Sullivan Springs trap. About 5,500 kokanee were placed above the trap to spawn naturally and assure a future egg source. Spawning efficiency in 1990 was 92%, which established a new record. Realistically, this is probably very close to the optimum achievable.

Rearing

Kokanee are feed-trained at 10°C using Rangens soft-moist starter until they are about 1.2 inches. At this time, the diet is switched to Oregon Moist Pellet (OMP) IV. Feed size starts at 1/32-inch, then to 3/64-inch, and sometimes 1/16-inch, depending on size objectives. These size objectives have changed from about 1.3 inches when the hatchery began operating, to a present request of 2 inches at release (Figure 5). Consequently, the hatchery capacity number has been reduced to meet this request.

The limiting factor in fish growth here continues to be a lack of available warm water (10°C) during the production months (Figure 1). Although the upper well field can yield up to 20 cfs, it is too cold to be used alone, and warm water from the lower springs must be added to temper it. Unfortunately, only 4.4 cfs is available from the lower springs, and only 12.4 cfs can be backed up by the generator should a power failure occur.

Because egg collection lasts over two months and a cross section of the run is required for each release strategy, growth rates need to be adjusted according to release timing. The growth rates of the early egg-takes are slowed by decreasing the water temperature and feeding rate. The late egg-takes are increased by raising the water temperature and feeding rate. By adjusting these parameters after the fry are feed-trained, a representative sample can be obtained from each egg-take, thus assuring optimum genetic diversity in each release (Figure 6).

A total of 7,777,700 kokanee fry were produced at an average length of 2.21 inches and an average weight of 321.6 fish/lb. This year class of kokanee is the largest size produced at the hatchery to date and should improve survival rates. These fish gained 23,626 pounds from 25,224 pounds of feed, resulting in an excellent conversion rate of 1.07:1.0 (Table 4). Fish feed production cost was $0.524 per pound and $1.62 per thousand.

Survival of green eggs to feeding fry was estimated at 89.5% (1988-89, 88.7%). Survival from first feeding to release was estimated at 90.7% (1988-89, 94.0%), resulting in survival from green egg to release of 81.2% (1988-89,

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Kokanee Lengths at Release
for different years and releases

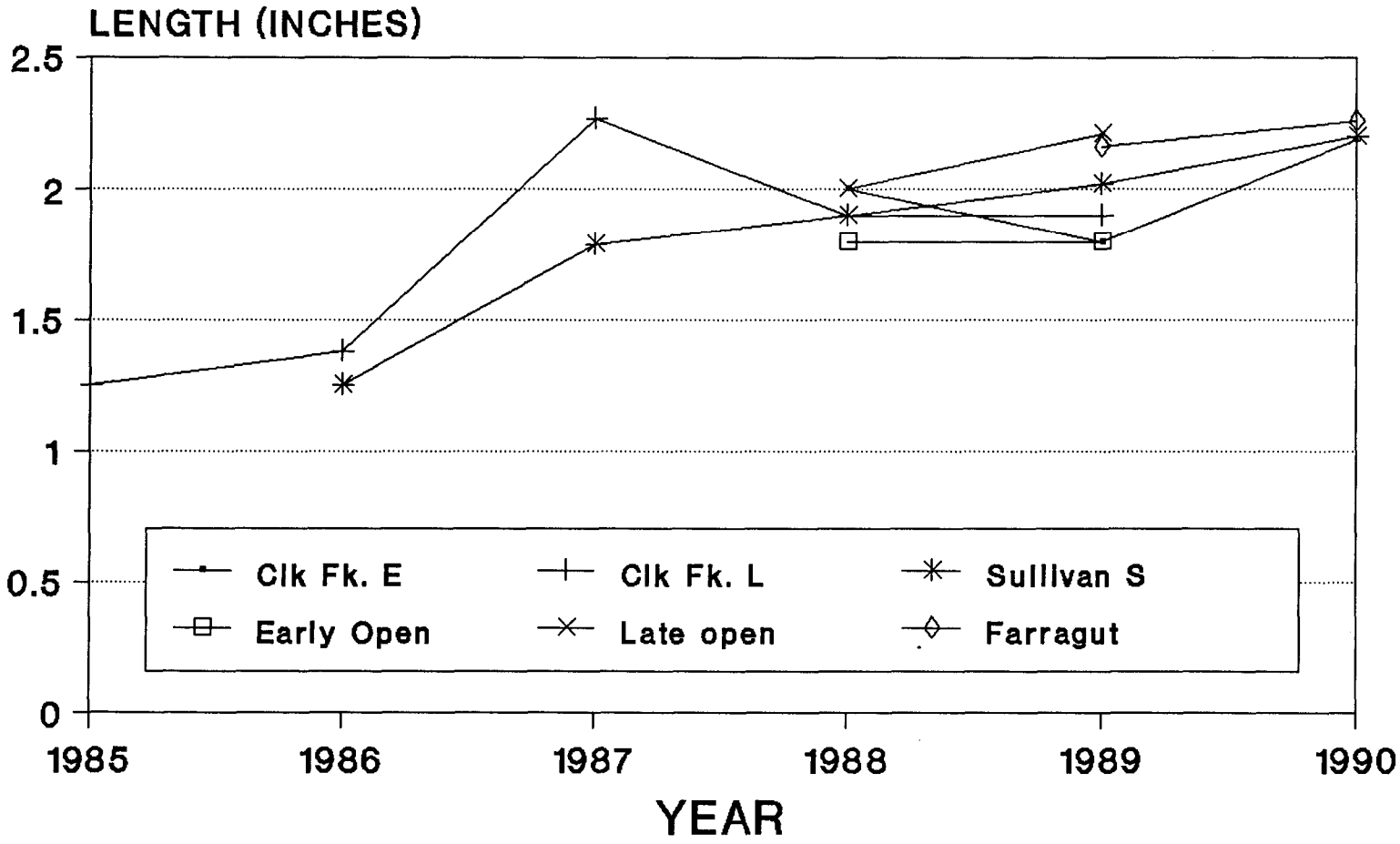

Figure 5. Kokanee length at release by location, 1985-90.

KOKANEE GROWTH RATES
FOR VARIOUS RELEASE SITES, 1989-1990

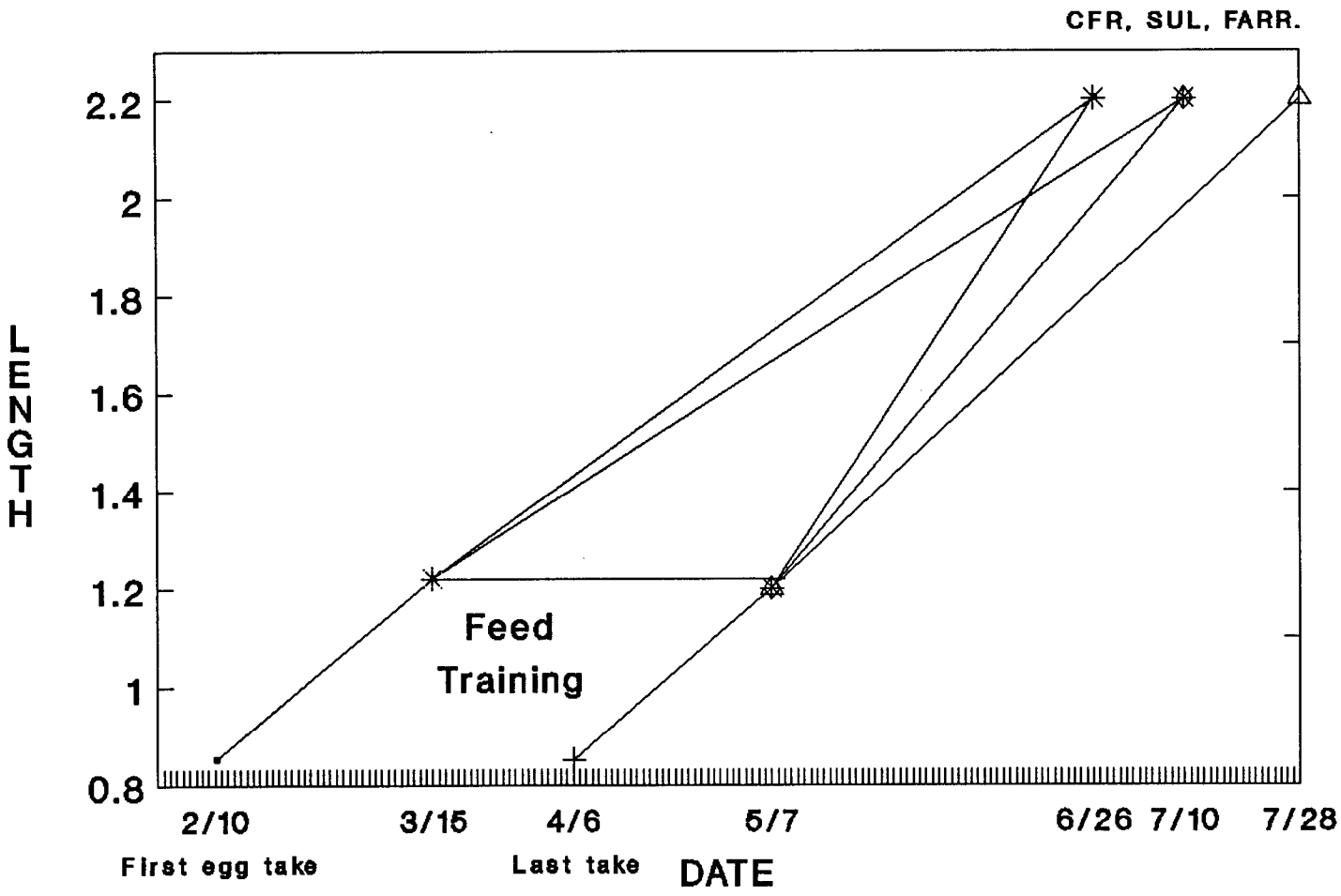

Figure 6. Kokanee growth rates for various releases, 1989-90

Table 3. Late-run kokanee trapping at Cabinet Gorge Hatchery, 1989-90.

	Total		Males		Females		Prespawning female	
Month	1990	(1989)	1990	(1989)	1990	(1989)	1990	(1989)
Nov	3,904	(2,140)	2,783	(1,547)	1,101	(589)	20	(4)
Dec	1,087	(324)	571	(89)	407	(217)	109	(18)
Jan	0	(0)	0	(0)	0	(0)	0	(0)
Total	4,991	(2,464)	3,354	(1,636)	1,508	(806)	129	(22)

Table 4. Kokanee production summary, Cabinet Gorge Hatchery, 1989-90.

Lot #	Number produced	Pounds produced	Pounds per 1,000	Feed fed	Weight train	Conv.
CF REL	3,429,700	10,983	3.20	11,749	10,413	1.13
SS REL	3,190,700	9,499	2.98	10,043	9,796	1.03
FAR REL	1,137,600	3,640	3.20	3,432	3,417	1.00
TOTAL	7,758,000[a]	24,122	3.11	25,224	23,626	1.07

[a]This figure does not include 19,700 (48.2 lbs.) transferred to Sandpoint Hatchery on July 26, 1990.

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83.0%) (Table 5). Survival for each egg-take from collection through release is shown in (Figure 7).

Fish Marking

Two of the 1990 release groups were marked (Table 6). The Clark Fork River and the Sullivan Springs releases had represented sample groups fin-clipped. A total of 60,000 Clark Fork River released fish were marked with a left ventral fin clip and 60,000 Sullivan Springs released fish were marked with an adipose fin clip. The Shoreline South (Farragut) release group was not marked. These fin clips will be used to estimate the rate of adult straying between the Clark Fork River returns and the Sullivan Spring returns. Terramycin (TM-50) was not used as a mass mark due to recent advances in otolith reading.

Fish Liberations

During June 1990, 3,429,700 fish were liberated from Cabinet Gorge Hatchery into the Clark Fork River. In July, 4,328,400 were liberated from Cabinet Gorge Hatchery. Of these, 3,190,700 were released in Sullivan Springs and 1,137,600 were released offshore at the south end of the lake at Farragut State Park boat ramp (Table 7).

Numbers at release were based upon egg inventory number minus mortality. All numbers were checked with a weight/sample-count number except the hatchery ladder release. Egg/mortality inventory numbers were within 0.6% of the weight/sample-count numbers for the trucked releases, therefore we believe the hatchery release number is accurate.

Kokanee in the Clark Fork River release and the Sullivan Springs release were imprinted with morpholine at 5 x 10-5 ppm for three days prior, during, and two days after release.

Clark Fork River-The hatchery release group of fry were flushed at dusk, using the fish bypass system, directly into the ladder. Only three raceways were released at any one time to prevent fry from washing against the settling pond deflector screens before entering the bypass pipe system. The entire release took less than two hours. Tempering was unnecessary as hatchery production water and the Clark Fork River water temperatures were both near 8°C. Although almost an entire raceway was lost when the flow was disrupted, survival for this group from egg to release was still 79.4%.

Because of the high flows in the river (64,000 cfs) during release, it was estimated that fry made it to the river in two to three hours. Quick outmigration of kokanee fry is essential for the successful rehabilitation of kokanee for Cabinet Gorge Hatchery because of the predator trap in the Clark Fork River and delta area.

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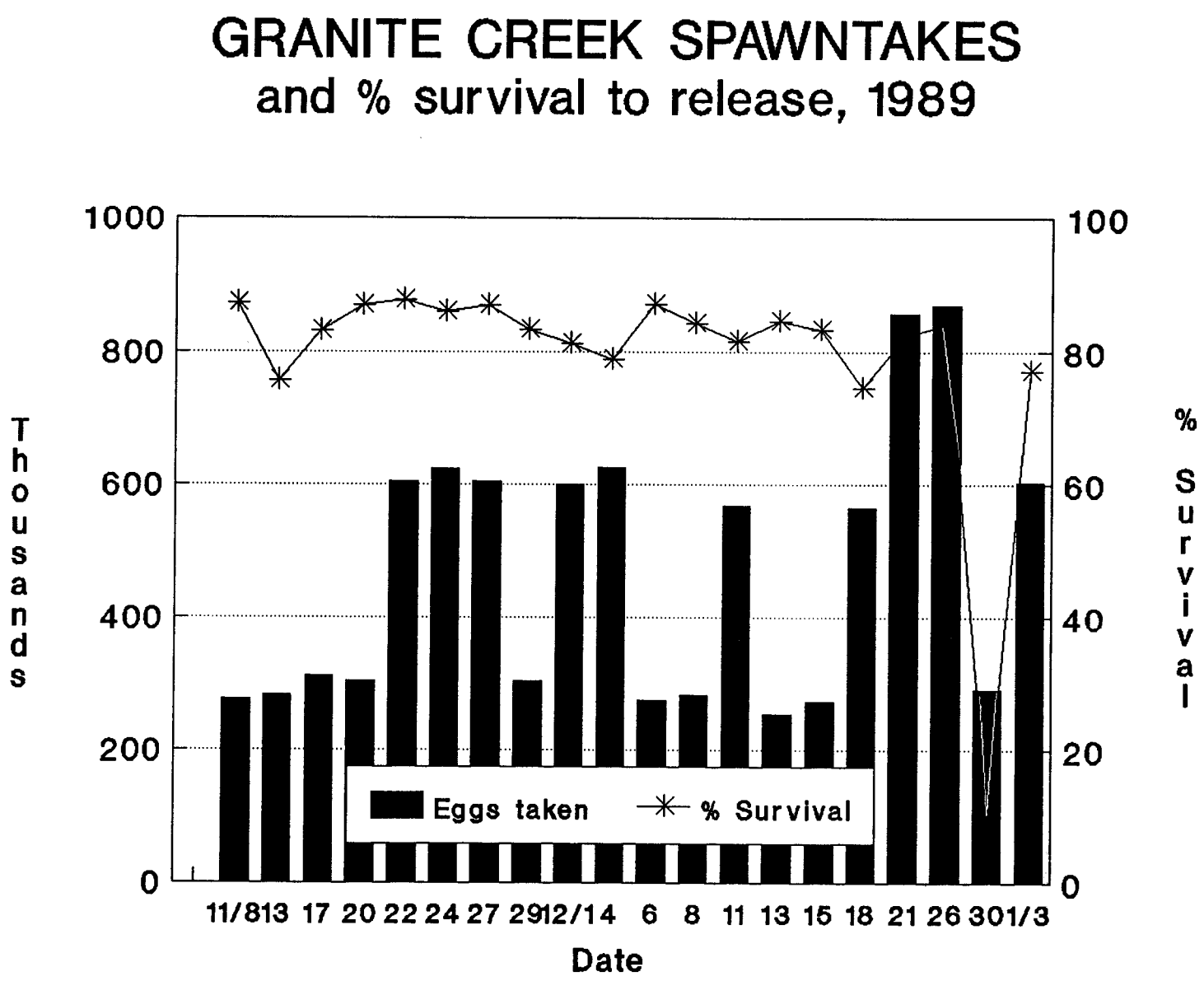

Figure 7. Granite Creek egg take and % survival to release.

Table **5.** Survival summary, kokanee salmon, Cabinet Gorge Hatchery, 1989-90.

Lot #	Number green eggs	Survival		
		Green egg to first feeding	Green egg to release	Feeding fry to release
CF	4,322,099	.90	.79[a]	.89
SS	3,829,953	.90	.84[b]	.93
FAR	1,427,708	.89	.81	.89
Total	9,579,760	.90	.81	.91

[a]Loss of raceway #53 prior to stocking
[b]lncludes 19,700 shipped to Sandpoint Hatchery

Table 6. Differential marks applied to different release groups of kokanee fry produced at Cabinet Gorge Hatchery, 1989-1990.

Release date Adipose	Release site	# fish released	Percent marked	Fin clip ventral	
				Left	Right
June 26	CFR-CG	3,429,700	1.7	X[a]	
July 10-12	SS	3,190,700	1.9		X[a]
July 24-25	Farragut	1,137,600			
		7,758,000			

[a]60,000 in each group.

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Table 7. Kokanee liberation from Cabinet Gorge Hatchery, June-July 1990.

Date	Release site	# fish released	Total pounds	Length inches	No./ lb
	Clark Fork River				
June 26	Cabinet Hatchery	3,429,700	10,983	2.19	312.0
	Pend Oreille Lake				
July 10-12	Sullivan Springs	3,190,700	9,499	2.20	335.9
July 24-25	Farragut	1,137,600	3,640	2.26	312.5
TOTAL	Pend Oreille Drainage	7,758,000	24,122	2.21	321.6

Tanker Hauling-The Shoreline South and the Sullivan Springs releases utilized the 10-wheel 2,100-gallon Corps of Engineers tankers. Some modifications were made to the tankers for hauling small fish. The agitators were completely closed off to prevent trapping fish inside, and the sight tubes for water displacement readings were also removed. The lids were equipped with weather stripping for a tighter seal.

Loading densities of small fish in the tankers ranged from 0.35 to 0.58 pounds per gallon (D.I. 1.2-2.0), with an average load density of 0.51 pounds per gallon.

Sullivan Springs

Tanker access into Sullivan Springs is limited. Fish were planted above the bridge on the access road to the Idaho Department of Fish and Game patrol cabin. The tankers were backed down the hill to the corner, and the fish were piped using 60 feet of 8-inch rigid discharge hose and 20 feet of collapsible hose. The collapsible hose was attached in the middle of the hose assembly and functioned to slow the discharge velocity during planting. Two tankers made up to two trips per day for three consecutive days to complete the plant.

It is recommended that prior to release, a tanker load of water be used to scour out a fry release pool.

Shoreline South

Tankers accessed the Shoreline South release at Farragut State Park's boat ramp. Sixty feet of 8-inch rigid discharge hose and 40 feet of 8-inch PVC pipe coupled with 10 feet of collapsible hose were assembled to discharge fry from the boat dock. Research expects better fry survival can be obtained if the fry are released at night away from structure-orientated predators. Two tanker loads on two consecutive nights completed the plant.

Problems were encountered with a tempering pump failure during the first night, and tankers had to be tempered by hand. One tanker was not tempered, and fish were released into water 17°F warmer. Fish appeared to adapt quickly, and an early morning inspection revealed less than 500 fish dead. Survival estimates from trawling indicate this release appeared unaffected by the temperature variation. This hardiness of kokanee to withstand extreme temperature differences was also seen at Lucky Peak Reservoir, where a similar temperature difference occurred with no immediate mortality on similar-sized fry.

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Other Fish Produced

Gerrard Rainbow

In 1988 and 1989, Cabinet Gorge Hatchery received pure Gerrard strain Kamloops eggs from Kootenay Trout Hatchery in Wardner, British Columbia, Canada, to establish a pure-strain spawning run up the Clark Fork River and eventually returning to Cabinet Gorge Hatchery. This will result in an improved trophy Kamloops fishery in Lake Pend Oreille and lead to the elimination of supplemental stocking by Clark Fork Hatchery of "non-pure" Gerrard Kamloops.

Because of two weak year classes, Kootenay Hatchery did not have any excess eggs in 1990. Consequently, this will result in a missing age-class when adults begin returning to the hatchery.

These Kamloops were divided into two groups: a "coolwater" and a "warmwater" group. The coolwater group represents fish that achieve growth comparable to Gerrards in the wild. The other group is being reared on warmer water to achieve an earlier returning adult, thus providing eggs one year earlier than its wild counterpart. Until it is determined which release results in the most adults returning to the ladder, both groups will be used.

1989 Gerrard-A total of 22,600 F2 Gerrard strain Kamloops were released into the Clark Fork River on April 9 (warmwater group) and June 26 (coolwater group). Prior to release, the coolwater group was marked with a left maxillary clip and left pelvic fin clip, while the warmwater group received a right maxillary clip and left pelvic fin clip. These marks will allow hatchery personnel to evaluate survival and separate pure from non-pure returning adults. Both groups were imprinted with morpholine at .00005 ppm for three days before release and two days after.

Survival from eyed egg to release was 75.0%. A total of 2,539 pounds of feed was fed to produce 2,129 pounds of gain for a conversion of 1.19:1. Feed production cost for these fish was $1,527, resulting in a feed cost per pound of fish of $0.72, or $0.068 per fish.

Bull Trout

A bull trout program has been established at Cabinet Gorge Hatchery to advance the knowledge of bull trout culture and provide bull trout fingerlings to fisheries managers for reestablishment or enhancement of suppressed populations in Idaho.

1989 Bull Trout-A total of nine adult bull trout were trapped at the hatchery during mid-September to mid-October 1989, with spawning occurring from

October 2 to October 20. Of the nine adults collected at the hatchery, three females were spawned yielding 10,677 eggs. Due to a shortage of males at the hatchery, four bull trout were also collected at Gold Creek, a south-western tributary of Lake Pend Oreille and crossed with four Clark Fork females to yield 12,282 eggs. Eggs from this cross all died before eye-up for unknown reasons.

Another 13 bull trout were also collected from Gold Creek, of which six were females (two were one-half spent) yielding 24,698 eggs. Spawning occurred from October 2 to October 20. Spawntaking yielded 47,657 green eggs. Survival to eye-up was fair (50%) (Table 8). Survival from eyed-egg to initial feeding was good (76%). The Clark Fork River group had 32.9% survival to eye-up. The Clark Fork River x Gold Creek cross were a total loss. The Gold Creek group had 85.1% survival to eye-up.

High fry mortality occurred until the fry had accumulated 1,000 CTU's, at which time mortality dropped ten-fold and growth rates increased. The bull trout fry remained on the bottom until they were about 2 inches, then moved up in the water column. About 3,400 fish were transferred to Sandpoint Hatchery on July 17. These 4.3-inch fish were released at Cabinet Gorge Hatchery's ladder on September 18, 1990 and were not imprinted.

1990 Bull Trout-A total of 21 adult bull trout were collected during mid-September to mid-October 1990 at the hatchery. Twenty-three bull trout were also collected from Gold Creek. Spawning occurred from September 27 to October 16. Eight females were crossed with 11 males (three were used twice). Clark Fork River spawntaking yielded 30,220 green eggs. Also, ten Gold Creek females were crossed with 13 males to yield 33,870 additional green eggs, for a total of 64,090 eggs taken in 1990. All eggs were shipped to Sandpoint Hatchery for incubation and rearing.

Chinook Salmon

Cabinet Gorge Hatchery is responsible for the spawning of fall chinook salmon in Lake Coeur d'Alene. Once the eggs have eyed at Cabinet Gorge Hatchery, they are shipped to Mackay Hatchery where they are hatched and reared until they are stocked back into Lake Coeur d'Alene.

This year, a total of 85 females were spawned between September 11 and October 16, 1990. These fish yielded a total of 297,340 green eggs (Table 9). These eggs were water-hardened and disinfected in Argentyne before being loaded into isolated Heath trays. Delayed fertilization techniques were utilized by hatchery personnel during the entire spawn-take in an effort to improve survival. This year, the volumetric displacement method of enumeration was used on these eggs. A total of 55,491 eyed-eggs were shipped to Mackay Hatchery. Survival to eye-up for eggs shipped averaged 57.1% (44.5% in 1989). The remainder of the eggs were destroyed. Lengths and fin clips were recorded, and ovarian fluid and tissue samples were taken and sent to Eagle Fish Disease Lab, IDFG. Results were negative for BKD and viral pathogens. All carcasses were donated **to** the Coeur

Table 8. Bull trout survival data, 1989-90.

	Green eggs	Eyed eggs	Swim-up fry	Fingerling (3.0")	Release (5.6")
Number---->	47,657	23,875	**18,645**	4,198	3,338
Green egg Survival to:		0,501	0,391	0,088	0,070
Eyed egg Survival to:			0,781	0,176	0,140
Button-up Survival to:				0,225	0,179
Fingerling Survival to:					0,795

Table 9. Summary of Wolf Lodge chinook spawntaking in September and October, 1990.

Date	Egg/ml	Total ml	Total eggs	Number female	Eggs per female	Number males
9/11	3.06	2,839	8,700	4	2,175	4
9/14	(Heat-shock exp.)		14,250	5	2,850	4
9/17	3.10	10,529	32,640	8	4,080	4
9/20	3.60	13,009	46,830	12	3,903	7
9/24	3.01	**19,086**	57,368	15	3,825	17
9/28	3.23	3,724	12,030	9	1,337	11
10/1	3.23	4,615	14,908	4	3,727	2
10/4	3.17	11,594	36,752	9	4,084	8
10/9	3.08	12,200	37,616	11	3,420	10
10/16	3.21	11,300	36,246	10	3,625	9
Total or Ave.	3.18	88,896	297,340	87	3,521[b]	76

[a]Average does not include 9/14 egg-take which was pooled.
[b]Average does not include 9/28 egg-take which included 2 partially spawned and 2 partially overripe females.

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d'Alene Food Bank. This year, a total of 1,825 pounds of fillets were voluntarily processed by Bob Smalley at Rosauers grocery store and delivered to the food bank.

Westslope Cutthroat

During June 1990, 31,000 eyed-eggs were received from Washoe Park State Hatchery in Anaconda, Montana. After disinfecting in 100 ppm Argentyne, these eggs were placed in Heath trays and isolated at the adult holding ponds until disease examination proved negative. Initial feeding began on July 6. Survival to initial feeding was estimated at 89.4%, resulting in 27,700 feeding fry. On July 26, 25,000 fry (8.7 pounds) were transferred to Sandpoint Hatchery.

In addition, 34,063 westslope cutthroat weighing 146 pounds and averaging 2.31 inches were carried over from September 30, 1989. A total of 2,014 pounds of feed was fed to produce 1,200 pounds of gain for a conversion of 1.68:1. About 27,100 fish weighing 1,346 pounds were also transferred to Sandpoint Hatchery in July 1990. These fish are being raised as a potential broodstock source.

FISH HEALTH

Kokanee

Annual brood stock inspection of Sullivan Springs kokanee tested negative for all obligate pathogens (Table 10). These results are consistent with previous years' results from this egg source. Annual kokanee fry inspection also tested negative for all pathogens examined.

Kokanee fry experienced episodes of increased mortality during the 1989-90 fish year due to Bacterial Gill Disease (BGD). Pathological investigations by hatchery personnel revealed motile rods in gill tissue. A treatment of 8.4 ppm Diquat or 10 ppm Chloramine-T for three consecutive days usually reduced mortality back to normal after six days. Subsequent raceways showing BGD symptoms were treated with Diquat or Chloramine-T before clinical outbreaks could occur. Both treatments proved effective in reducing BGD-related mortalities. Mortalities caused by "plugged gut" and bacterial gill disease episodes claimed less than 2% of the fish inventory. Low losses due to "plugged gut" this past year can probably be attributed to higher rearing temperatures because of an abundance of warmer water due to low egg take numbers.

Table 10. Fish health summary, Cabinet Gorge Hatchery, 1989-90.

	Sample dates	VH	VP	VE	BK	BR	BF	BC	PW	PC
Adults										
SS kokanee	12-1-89	-	-	-	-	x	x	x		
WL chinook	10-20-89	-	-	x	-	x	x	x		
WL chinook	9-24-90	-	-	-	-	x	x	x		x
SS kokanee	11-28-90	-	-	-	-	x	x	x		
CF kokanee	11-29-90	x	x	-	-	x	x	x		
Fry										
SS kokanee	7-19-90								x	x
ID Bull trout	5-10-90								x	x
MON-C2	5-10-90								x	x
Eyed Eggs Received										
MON C2[a] (westslope)	5-23-90							x	-	x

[a]Inspected by Montana Dept. of Fish, Wildlife, & Parks prior to shipment.

\+ Positive results
\- Negative results
x Not sampled

VH = IHNV, infectious hematopoitic necrosis virus
VP = IPNV, infectious pancreatic necrosis virus
VE = EIBS, erythrocytic inclusion body syndrome virus
BK = bacterial kidney disease
BR = enteric red mouth
BF = bacterial furunculosis
PW = whirling disease agent, Myxobolus (Myxosoma) cerebralis
PC = Ceratomyxa shasta, agent of ceratomyxosis

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Other Species

All eggs were certified disease-free or disinfected in Argentyne before entering the hatchery. If possible, other species were isolated in the adult holding ponds until released or until disease inspection had been completed. All intra-state programs were certified by the Eagle Health Lab, IDFG (Table 10). The Gerrard Kamloops and Westslope cutthroat were examined **by** their respective agencies and certified "disease-free".

Except for a very rare outbreak of BGD, these other species exhibited excellent health during the rearing period. The bull trout developed some fungal problems during early rearing, but after treating with Chloramine-T or Diquat, fish health returned to normal.

SPECIAL STUDIES

Rolling Green Eggs

No fungicide was used on the 1989-90 year class of kokanee. This was the first year that the entire program depended on rolling the eggs to prevent fungal development after two successful trial years on limited groups of eggs. The principle behind this method is to gently roll the eggs to prevent fungus from starting. It is important to maintain a constant flow through the eggs during the tender period, and also to assure that no dead areas develop in the incubators.

Approximately 120,000 eggs were placed into 12-inch vertical upwelling incubators after disinfecting and enumerating, then gently rolled until eye-up. At this time, the flows were increased and continued until the incubators were empty. Flow rates varied from 6 to 9 gpm until eye-up, then were increased to 11 to 15 gpm. Survival to fry-sort (90%) was the best since hatchery operations began in 1985, thus proving the method works. Rolling green eggs eliminates the expense of fungicide, labor costs, and health risks and should be examined at other hatcheries on different species.

Feed Experiment

Three feed brands, Biosponge, Bioproducts, and a control diet using Rangens soft-moist starter and Moore-Clark OMP IV, were examined to determine optimum performance on juvenile kokanee salmon. About 750,000 fry were used in the experiment, which lasted about 4 months.

The fish fed the control diet outperformed the other two, although Bioproducts did well also (Table 11). The control diet resulted in the best

Table 11. Results of feed experiment at Cabinet Gorge Hatchery, 1990.

Raceway	59	60	61
Feed brand	Rangen/Moore-Clark	Biosponge	Bioproducts
Feed type	soft-moist/OMP IV	Salmon	Biodiet, Grower
Feed size	Str #1; 1/32, 3/64	#0,1,2	Str #1&3;1.0,1.3mm
Ending number	234,547	187,517	201,768
Weight (lbs)	740.55	488.85	613.10
Fish/lb	316.90	384.10	329.60
Length (")	2.31	2.07	2.19
Cond. Fact (C)	2.57	2.94	2.88
Mortality	32,703	70,083	43,082
% Survival	87.76	72.79	82.40
Length Inc.(")	1.44	1.20	1.32
Food Fed (lbs)	705	503	594
Weight gain (lbs)	695.54	443.85	567.10
Conversion	1.01	1.13	1.05
Feed cost/lb	0.498	0.462	0.712
Cost/lb fish	0.509	0.623	0.916

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conversion, lowest mortality, best growth rate, and was the least expensive per pound of fish produced. The group fed Bioproducts performed very well also, but the feed costs were significantly higher. The group fed Biosponge performed very poorly, and pinheading and high mortalities were commonplace. The feed appeared to be unpalatable to the kokanee. It is recommended that the control brand be continued at Cabinet Gorge Hatchery, although, if problems arise with it, Bioproducts would be a good alternative diet.

Baffles

During the 1989-90 fish year, personnel at Cabinet Gorge Hatchery examined an alternative to sweeping raceways. Baffles were installed which move the settleable solids to the back of the raceway where they can be quickly swept into the discharge pipe. This method reduced the time spent cleaning raceways by 75% and improved the environment of the fish.

Baffles were constructed of high-density 1/8-inch black polyethylene and weighted on the bottom using 3/4-inch painted rebar. Usually, baffles are constructed with "legs" to keep them off the bottom. This variation using rebar allows the baffle to swing with the water flow; this allows the standpipes to be pulled for cleaning. Their lightweight construction and ease of placement made them ideal for immediate removal should conditions warrant. Polyethylene is less expensive than all other materials examined except wood and was most efficacious for our purposes. Baffles were used in all raceways with excellent success and will be used again next year.

Delayed Fertilization

Spawntaking in remote locations has proven to be rough on the eggs when they are fertilized at the site and shipped over rough roads back to the hatchery. This travel time can often last several hours and result in low survival for the eggs. Because of this, the process of delayed fertilization was used on bull trout from Gold Creek and all chinook salmon in 1989 and 1990.

Gametes were taken from adults in their natal streams. The eggs were stored with the ovarian fluid in Ziploc bags and the air was removed from the bag. The bag was then placed on ice in a cooler. The sperm was stripped into whirl-pak bags, air was introduced, and the bags were sealed and placed on ice also. The gametes were then fertilized back at the hatchery after tempering, and the spawntaking procedure continued. This process has proven to be a viable alternative to the old procedure and allows the individual to work with better equipment and conditions back at the hatchery. It also lessens the amount of time spent in the field when time is often too short.

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Sterilization

Limited numbers of sterile kokanee and fall chinook were requested by management personnel. This technique is still very new at this hatchery, and survival and induction rates are less than hoped for.

Sterilization is accomplished by fertilizing the eggs at the hatchery at 10°C, then after 10 minutes the eggs are immersed into a 28.5°C water bath for 10 minutes. The eggs are then tempered back down and placed in Heath trays for incubation.

This program shows promise but needs to be refined before a full-scale program can be initiated. With further experimentation, hopefully the survival and induction rates will improve and a successful program can be implemented.

Fall Chinook

Poor survival among the chinook could probably be attributed to rolling the eggs ineffectively. The small number of eggs, their large size, and the large incubator all combined to decrease survival. Survival to eye-up was much better (37%) in 1990 than in 1989 (20%) because Heath trays were used during incubation; although historically, these chinook usually have poor survival to eye-up (around 50%) because of poor egg quality. The induction rate for the Chinook was 71%.

Kokanee

Survival to eye-up in the heat-shocked group of kokanee was 23%, while the induction rate was 62%. These kokanee have much better survival to eye-up (90%) than the chinook, so actually the survival results, although the percentage was higher in 1989 than the chinook, are really worse than the chinook. Hopefully these percentages will improve as more knowledge and experience is acquired about this process.

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